REMARKS/ARGUMENT

This letter is responsive to the Office Action mailed on August 9, 2005. The claims have been amended in response to the outstanding Office Action and new claims 6 to 9 have been added. No new matter has been added by the amendments.

Claims 1 to 9, as amended, are currently pending in the application.

Rejection under 35 U.S.C. 112 second paragraph

The Examiner has rejected claims 2 and 5 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The Examiner states that the term "end" in claim 2 is unclear and that it will be interpreted as being "end cap". Claim 2 has been cancelled by the present amendments.

The Examiner also states that claim 5 is incomplete since it omits essential structural cooperative relationships of elements amounting to a gap between the necessary structural connections. Specifically, the Examiner states that a structural cooperative relationship must be provided between the maximum radius regions and the minimum radius regions being dimensioned to match the torque of the actuator and the microwave T-switch. In response, the Applicant has amended claim 5 to cover the actuator in combination with a T-switch having an rf module, wherein said maximum radius regions and said minimum radius regions are dimensioned so that in the presence of current, high torque is achieved when the resisting load from the rf module is greatest. Support for these amendments are provided in the disclosure at page 12, lines 18 to 29.

Accordingly, the Applicants respectfully submit that the claims, as amended now comply with the second paragraph of 35 U.S.C. 112.

Claims 1 to 5 rejected under 35 U.S.C. §103(a) in view of Walker et al. and Honsinger et al.

The Examiner has rejected claims 1 to 5 under 35 U.S.C. §103(a) as being obvious in view of Walker et al. (U.S. Patent No. 3,959,672) and Honsinger et al. (U.S. Patent No. 4,388,545).

Specifically, the Examiner states that the Walker et al. reference discloses a hybrid switch actuator that includes a stator having six pole shoes (12 in FIG. 1 of Walker et al.) where each pair of opposed pole shoes are associated with a common exciting coil (col. 1, lines 40-51, FIG. 1 of Walker et al.) and where when two diametrically opposed stator pole shoes having a first polarity are excited through their associated common exciting coil, the stator pole shoes attracting two diametrically opposed rotor poles having an opposite polarity to the first polarity and repel the remaining two rotor poles such that each rotor pole associated with a maximum radius region can be precisely aligned with a stator pole associated with a stator pole shoe (col., 1, lines 40-51 of Walker et al.).

Also, the Examiner states that Honsinger et al. reference discloses a rotor package rotatable along a rotation axis and adapted to be positioned within the stator, having two pairs of rotor poles magnetized transversely in alternate directions, and including a permanent magnet ring (3 in FIG. of Honsinger et al.) magnetized along the rotation axis and two end caps (11, 13 in only FIG. of Honsinger et al.) adapted to be engaged around said permanent magnet ring, each end cap having two maximum radius regions that each correspond to the area of each of the stator pole shoes (FIG. 1, col. 2, lines 27-28 of Honsinger et al.).

In response, the Applicant has amended claims 1 to 5 to better define the claimed subject matter and to clarify the distinction between this claimed subject matter and the cited prior art references.

Specifically, claim 1 has been amended to specify that each end cap of the hybrid switch actuator also has four reduced radius regions, two of each reduced radius regions being positioned adjacent to each maximum radius region and wherein the difference between the radius of the maximum radius regions and the radius of the reduced radius regions is substantially smaller than the radial dimensions of the rotor package such that when the minimum radius regions adjacent to the maximum radius regions of the diametrically opposed rotor poles overlap the stator pole shoes having a first polarity, a reduction of the reluctance gap therebetween occurs. Support for these amendments are provided in the disclosure at page 5, line 28 to page 6 line 1, page 8 lines 4 to 30, page 9, lines 1 to 9, page 9, line 10 to page 11, line 22 and FIGS. 3A, 3B, 3C, 4A, 4B, and 4C.

The Applicants respectfully submit that claims 1 to 5, as amended, are not obvious in view of Walker et al. and Honsinger et al.

It is an established principle that when considering whether a particular reference is citable prior art, it is not the difference and similarity between the two arts generally that matters, but rather, it is the difference and similarity in terms of the <u>particular problems</u> to be solved (*Automatic Arc Welding Co. v. A.O. Smith Corp.,* (1932) 60 F. 2d 740, 14 U.S.P.Q. 127 (7th Cir. 1932)). The Applicant respectively submits that the Walker et al. and Honsinger et al. references discloses devices that are directed to a substantially different problem than the presently claimed invention.

The Walker et al. reference discloses a variable switched reluctance electric motor that uses a stator including at least three pairs of pole pieces with windings surrounding at least one of the pole pieces of each pair and a rotor structure. The Walker et al. motor is

a single excited device with a driven coil on the stationary part and soft ferromagnetic material on the moving part. Force is developed as the moving part tends towards an orientation in which the magnetic reluctance is minimum and there is zero un-powered torque. These kinds of actuators only operate efficiently where small angular (i.e. less than 60 degrees) displacements are required and as is conventionally known, a variable reluctance actuator does not have stable positions in the absence of current (Invention Disclosure, page 2, line 5 to 14).

The Honsinger et al. reference discloses a rotor package for a permanent magnet AC motor. The rotor package includes a permanent magnet disk mounted on a shaft and two starting disks of current carrying material mounted on either side of the magnet to act as starting coils. Pole pieces are mounted on either side of the starting disks and have claw-like projections spaced about and extending from the periphery of the pole pieces. These claw-like projections extend inwardly over the magnet and starting disks. The claw-like projections from each pole piece are interlaced forming rotor poles of alternating polarity. The permanent magnet motor which is a doubly excited device in which magnetic flux is generated by a driven coil on the stationary part and a permanent magnet on the moving part and force is developed through the mutual flux linkages. Typically, permanent magnetic devices exhibit residual torque properties that tend to hold the actuator in preferred locations when unpowered and these effects (due to the influences of the magnets) must be overcome when applying power to achieve a new position diminishing the ultimate performance of the actuator (Invention Disclosure, page 1, line 19 to page 2, line 4).

In contrast, the presently claimed invention is directed to a hybrid switch actuator which operates in the presence of current and which also maintains a stable position in the absence of current. The presently claimed invention is a true hybrid switch actuator that exhibits properties of both permanent magnet motors (i.e. permanent poles) and variable reluctance motors by varying magnetic reluctance across the air gap achieved by optimization of the pole geometry.

Accordingly, since the Walker et al. reference is concerned primarily with improving the operation of a variable switched reluctance machine and since the Honsinger et al. reference is directed at a claw-pole structure for a permanent magnet motor device that realizes alternating poles using a single magnet, it is submitted that there is a substantial difference in the particular problems to be solved and the underlying technical fields and that the Walker et al. and Honsinger references should not be considered analogous art in this case.

Even if the Examiner still considers the Walker et al. and Honsinger et al. references to be applicable prior art in the present case, the Applicant submits that providing the end caps of the hybrid switch actuator with four reduced radius regions, such that the difference between the radius of the maximum radius region and the radius of the reduced radius regions is substantially smaller than the radial dimensions of the rotor package such that when the minimum radius regions overlap the stator pole shoes, a reduction of the reluctance gap therebetween occurs is not obvious in view of the Walker et al. and Honsinger et al. references.

The rotor structure of Walker et al. contains circumferential extensions 15 and 16 which extend on opposite sides of diametrically disposed pole pieces 14 and which are shown to be of the same radial length (Walker et al., FIGS. 2 and 3). There is nothing disclosed in Walker et al. to either show or suggest the reduction of the reluctance gap between the stator and the rotor through the use of reduced radius regions as claimed in the present invention. Rather, as is common in the art, the rotor structure of Walker et al. provides large pole-isolating gaps in between the rotor poles.

Also, Honsinger et al. discloses a rotor package having pole pieces 11 and 13 with extending interlaced claw-like projections. Also, there are intermediate regions on the pole pieces 11 and 13 that are run in between the claw-like projections and have a lesser radius (Honsinger et al. FIG. 1). There is nothing disclosed in Honsinger et al. to either show or suggest the reduction of the reluctance gap between the stator and the

rotor through the use of reduced radius regions as claimed in the present invention. Accordingly, the difference between the radius of these regions on the pole pieces 11 and 13 and the radius of the pole pieces 11 and 13 at the site of the interlaced claw-like projections appears to have simply and conventionally been intended to ensure that the poles are properly magnetically isolated. In fact, it is generally well known in the art that rotor/stator poles are associated with surfaces that present very small air gaps and any interface that does not present a small air gap is considered non-operative (i.e. magnetically isolating).

Accordingly, the Applicants submit that it would not be obvious to one of ordinary skill in the art in view of Walker et al. and Honsinger et al. to provide each of the end caps of the hybrid switch actuator with four reduced radius regions, such that the difference between the radii of the maximum radius regions and the reduced radius regions is substantially smaller than the radial dimensions of the rotor package such that when the minimum radius regions overlap the stator pole shoes, a reduction of the reluctance gap therebetween occurs.

Finally, the Examiner states that it would have been obvious to one of ordinary skill in the art at the time that the invention was made to use the easily manufactured rotor of Honsinger et al. in the stator of Walker et al. in order to reduce the cost of the rotor. The Applicant submits that the principles taught by the Walker et al. and Honsinger et al. references are so different that one of skill in the art would not.be motivated to combine them to gain the desired result claims in the present claims, as amended.

As discussed above, the Walker et al. reference is concerned primarily with improving the operation of a variable switched reluctance machine. Also, the Honsinger et al. reference is directed at a claw-pole structure for a permanent magnet motor device that realizes alternating poles using a single magnet. Due to formidable differences in magnetic behaviour and design of a permanent magnetic motor device and a variable

switched reluctance machine, it would not be possible to produce a working motor by combining the rotor of Honsinger et al. with the stator of Walker et al.

As an illustration of this fundamental incompatibility, the rotor of Honsinger et al. is a six pole rotor and the stator of Walker et al. is a six pole stator. Permanent magnet DC motors typically have different numbers of stator and rotor poles or non-uniform spacing between either the rotor or stator poles. The result of placing the Honsinger et al. rotor within the Walker et al. stator would be that all six of the permanently magnetized rotor poles will align to the six stator poles. Since the Walker et al. stator provides an efficient magnetic return path for the permanent magnet flux, it is unlikely that the induced magnetism from the stator coils would produce enough torque to dislodge the rotor.

Also, it should be noted that the stator in Walker et al. is comprised of pole pieces provided with windings that are connected so that when supplied with uni-directional current, the pole pieces of the pair will be of opposite magnetic polarity (Walker et al., Col. 1, lines 47 to 51). In the rotor of Honsinger et al. the interlaced claw-like projections extending from the pole pieces form alternating north and south poles with the polarity of the projections determined by its associated pole piece (Honsinger et al. Col. 2, lines 51 to 54). Due to the physical structure of the rotor of Honsinger et al. diametrically opposite rotor poles will be of opposite magnetic polarity.

In contrast, the operational principle of the hybrid switch actuator as presently claimed requires that each pair of opposed pole shoes and each pair of opposite rotor poles are of similar magnetic polarity. Accordingly, it is submitted that even if the rotor of Honsinger et al. could be said to work within the stator of Walker et al., the fundamental operation of such a device would not correspond to that of the claimed hybrid switch actuator.

Accordingly, the Applicant submits that there would not be any reasonable motivation for someone skilled in the art to utilize the rotor of Honsinger et al. within the stator of Walker et al. to build the hybrid switch actuator of the present invention.

Accordingly, the Applicant respectfully submits that the subject matter claimed in independent claim 1, as amended, is not obvious in view of the Walker et al. and Honsinger et al. references. It is further submitted that claims 3 to 5, as amended, recite additional patentable features that are neither taught nor suggested by the Walker et al. or Honsinger et al. references. Withdrawal of the Examiner's rejection in respect of claims 1 to 5 is respectfully requested.

New Claims 6 to 9

The Applicant has introduced new claims 6 to 9 that relate to additional particulars concerning the difference in radius of the maximum radius regions and the minimum radius regions and the polarity of opposed stator pole shoes and rotor poles. Support for these new claims are provided in the disclosure at page 5 line 28 to page 6, line 1, page 8 lines 14 to 17, and FIGS. 3A, 3B, 3C, 4A, 4B and 4C.

Specifically, the percentage values provided in claims 6 to 7 are obtained in reference to the ranges provided in the disclosure at page 5 line 28 to page 6, line 1, page 8 lines 14 to 17, namely "the magnitude of the radius difference between the maximum radius region and the reduced radius region is typically 0.05 mm to 0.10 mm", "permanent magnet is preferably manufactured to have a thickness .... in the range of 4 to 12 mm", and "permanent magnet preferably has a diameter in the range of 12 to 15 mm".

References Made of Record and Not Relied Upon

The Applicant has briefly reviewed the other references cited by the Examiner. The Applicant respectfully submits that these references do not recognize the problem solved by the present invention and do not describe or even suggest the present invention. The Applicant respectfully submits that they are not relevant to the patentability of the claims of the present invention.

In view of the foregoing, the Applicant respectfully submits that the application is now in condition for allowance. If the Examiner believes that a telephone interview would expedite allowance of the application, the Examiner is respectfully requested to contact the undersigned at (416) 957-1680.

Respectfully submitted,

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